DOCUMENT RESUME

ED 410 734 EC 305 794

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TITLE Enhanced Learning through Electronic Communities: A Research Review.
INSTITUTION Washington State Office of the State Superintendent of Public Instruction, Olympia. Div. of Adult Education and Community Schools.; Washington Univ., Seattle.
SPONS AGENCY National Science Foundation, Washington, DC.
PUB DATE 1996-02-00
NOTE 30p.
PUB TYPE Information Analyses (070) -- Reports - Research (143)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Community Benefits; *Community Development; *Computer Mediated Communication; *Computer Networks; *Computer Uses in Education; Cooperative Learning; *Electronic Mail; Elementary Secondary Education; Guidelines; Special Education; Surveys; Teacher Participation; User Needs (Information); User Satisfaction (Information)

ABSTRACT

This report, in support of the project "Enhanced Learning through Electronic Communities," investigated successful practices of electronic communities. A literature review was conducted and a survey was sent to 15 system operators of networks that had a community-based focus with ancillary educational components and networks that focused primarily on education. The report summarizes findings of the published literature and provides an electronic resources review and results of the survey. The benefits of computer-mediated communication are discussed, including collaborative learning among students. Steps to establishing a successful educational electronic community are provided. These include: (1) addressing program goals and user needs; (2) involving the greater community, including people from the Chamber of Commerce, phone company, university computer department, United Way, public radio or television station, local newspaper, public library, and an attorney and accountant; (3) involving teachers in planning the system to develop grassroots support; (4) promoting a positive online culture; (5) delivering appropriate instruction, including idea generating, idea linking, and idea structuring types of learning; (6) allowing enough time to develop electronic communities and an online culture; (7) addressing technical and support issues, such as being user friendly, being compatible with the exiting state university system, and accessible to all school systems; and (8) obtaining financial and administrative support. (Contains 27 references.) (CR)

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ED 410 734

Enhanced Learning Through Electronic Communities:

A Research Review

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February 1996

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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This report is in support of the project "Enhanced Learning Through Electronic Communities" which is coordinated through the Washington State Office of Superintendent of Public Instruction. Funding for this report is provided by the National Science Foundation, the Office of Superintendent of Public Instruction, and the University of Washington.

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Enhanced Learning Through Electronic Communities:

A Research Review

Computer-mediated communication, fueled by the explosive growth of the Information Superhighway, has great potential to create electronic communities to facilitate learning. This report suggests how electronic communities can deliver and enhance pre-college education, details successful and unsuccessful practices of these electronic communities, provides guidance on successful implementation of educational technology, and summarizes advice to others from existing electronic communities. The study focuses on several aspects of electronic communities: planning and implementation, technical considerations, finances and administration, value to users, community involvement, user training, community culture, and delivery of education. A review of the literature and electronic resources on electronic communities and a survey of existing communities were the methods used. The results may be useful to communities involved in the "Enhanced Learning Through Electronic Communities" project in Washington State and to others seeking to develop electronic learning communities.

Background

The Washington State Office of Superintendent of Public Instruction (OSPI) was awarded a $100,000 planning grant from the National Science Foundation (NSF) under its Networking Infrastructure for Education Program on behalf of a state-level partnership. Current partners include the Washington School Information Processing Cooperative, educational technology support centers, educational service districts, the University of Washington, the Higher Education Coordinating Board, Communications Technology Center for Washington Community and Technical Colleges, Washington State Library, New Horizons for Learning, Washington State Commission on Student Learning, Washington State Department of Information Services, and Awakening Technology.

The ultimate goal of the project is to increase the academic achievement of K-14 students in the academic areas of mathematics, science, and social studies by using environmental studies and community-based telecommunications as catalysts and tools for relevant, interdisciplinary learning based upon real-life experiences. Secondary outcomes include civic participation in environmental issues and public policy through community forums including telecommunications networks.

This planning grant enables project partners to develop five implementation models of collaborative, community-based infrastructure to improve and extend learning opportunities and civic participation in community issues. These community-based telecommunication prototypes will engage K-14 learners and community members in researching, analyzing, and collaboratively addressing environmental issues identified by the community. As part of the planning process, research was conducted in order to uncover critical success factors in creating and maintaining online communities.

The basic research question addressed is "What lessons can the project partners and five communities learn from existing community-based telecommunications projects?" A review of the literature and electronic resources was conducted to investigate successful practices of electronic communities. In addition, electronic mail surveys were distributed to the system operators of networks with a community-based focus with ancillary educational components and networks focusing primarily on education. Each electronic community was asked to provide information regarding the following: purpose of the community, populations served, level of user activity, groups involved in establishing and running the network, the formation process, planning strategies, staffing levels, funding issues, technologies used, access methods, expected and actual cultures of the online community, training procedures, success stories and problems encountered, and advice for new communities. Fifteen responses were received and their comments were incorporated into this report. The data collected from existing communities confirmed trends and theories culled from published research.

The following sections summarize the findings of the published literature and electronic resources review and the survey. It is hoped that this information is useful to the project partners and the communities of the Washington state Enhance Learning Through Electronic Communities project and to other groups as they develop implementation plans.

The Promise of Online Education

Computer-mediated communication (CMC) has been touted as a means to invigorate and resculpt the educational system, facilitate delivery of education, and improve student learning. How can electronic educational communities realize their potential to provide and even improve education?

Computer-mediated communication has been defined as:

> The use of computers and computer networks as communication tools by people who are collaborating with each other to achieve a shared goal, which do not require the physical presence or co-location of participants, and which can provide a forum for continuous communication free of time constraints. (Kaye, 1991, p. 5)

Computer-mediated communication combines attributes of both speech and writing. It is interactive and spontaneous like speech, but shares the permanency and reusability of written messages.

Computer-mediated communication can facilitate group interaction by gathering people with common interests or goals into an online community where participants can communicate at their own convenience, unrestrained by geographical and temporal constraints. CMC can form connections between participants who might not have otherwise met. Computer technology serves as a conduit for human communication. The use of electronic mail, computer bulletin board, discussion lists, and messaging systems encourages and facilitates many types of interaction between participants: one-to-one; one-to-many; and many-to-many. The lack of social cues revealing appearance, disabilities, or social status of the user; a lack of censorship before message transmission that encourages spontaneity; and a lack of hierarchical structure, allow users with a variety of socioeconomic and bureaucratic levels to communicate freely with one another.

Computer-mediated communication can lead to formation of special interest communities that provide a social context for users. Electronic communities share some elements of traditional communities including social interaction based upon geographical proximity, shared consciousness, and common goals (Bell & Newby , 1974). Author Howard Rheingold defines electronic communities as "Social aggregations that emerge ...

when enough people carry on those public discussions long enough with sufficient human feeling, to form webs of personal relationships in cyberspace" (Rheingold, 1993, p. 5). In the educational sense, "an electronically networked community is one bound by common use or purpose rather than by physical location, technological orientation, institutional affiliation, grade level, or subject area" (Kurshan, Harrington, & Milbury, 1994, p. 2).

People join and participate in electronic communities because they offer users "collective goods" of value.

> Every cooperative group of people exists in the face of a competitive world because that group of people recognizes there is something valuable that they can gain only by banding together. Looking for a group's collective goods is a way of looking for the elements that bind isolated individuals into a community. (Rheingold, p. 13)

These collective goods include social network capital (ready made connections with an established electronic group); knowledge (the ability to solicit advice from others in the community); and communion (the ability to solicit and receive moral support from community members). Types of communities include those that are primarily relationship-based, task-based, geographic-based, and topic-based (Rheingold, 1993). This research focuses primarily on communities with common interests or goals that may also share a common geographic locale.

The establishment of electronic communities through computer-mediated communication holds significant promise for education. Computer-mediated communication in education can be grouped into three categories: **conferencing**, which includes electronic mail, interactive messaging, and group discussion; **informatics**, access to repositories of organized information like online library catalogs and informational databases, and **computer-assisted instruction (CAI)** to structure information and responses, including activities like guest lectures, project-based instruction, student mentoring and tutoring, student collaboration through discussion lists, interactive chats, and computer-based simulations and tutorials (Berge & Collins, 1995). Tools include electronic mail, real-time chat services, file retrieval, remote login, bulletin

board services, discussion lists, electronic conferences, specialized databases, and general-purpose information interface (e.g. gopher and World Wide Web servers). They can support the delivery of instruction and enhance teacher-to-student and student-to-student interaction (Berge and Collins, 1995).

Computer-mediated education can be tailored to the individual learner, accommodating different capabilities, learning styles, disabilities, and cultural backgrounds (Berge and Collins, 1995). It has the potential to facilitate communication and information-sharing among scholars, experts, parents, and students; help teachers implement new teaching techniques and improve student learning; expand the walls of the classroom by exposing students to a wide range of experts and resources; provide access to up-to-date materials; improve student communication and problem-solving skills; teach students skills that will be useful in the workplace; reduce the isolation of students and teachers; promote collaborative and active learning; enable student-directed investigation; encourage group development and electronic distribution of curriculum materials; and assist with teacher's professional development (Kurshan et al., 1994; Office of Technology Assessment, 1995; Hartman, Neuwirth, Kiesler, Sproull, Cochran, Palmquist, and Zubrow, 1995; O'Shea, Kimmel, and Novemsky, 1990).

With the addition of online student activities, the classroom "becomes a place in which learning is not only based on facts, but also on the exploration of information, the discovery of new structures for discussion, and the analysis of data" (Kurshan, 1991, p. 47). Computer-mediated communication has been shown to be as effective as the traditional educational environment. On average, students using computer-mediated communication can learn just as well as students in a traditional environment, as measured by mid-terms, final examinations, and student grades. However, the more mature and better students tend to learn more, and students without strong study habits learn less (Turoff, 1990).

Successful electronic education capitalizes upon the unique characteristics of computer-mediated communication. CMC supports both synchronous communication (where both participants are online at the same time) to overcome geographic constraints; and asynchronous communication (where both participants are not required to be logged in at the same time) to make communication across different time zones convenient. The removal of social cues and social distinctions like disability, race, and facial expression through text-only communication can make even shy users feel more confident about communicating with others. Students can learn in the ways that people learn best -- through sharing information with peers, questioning information, verbalizing opinions, weighing arguments, and active learning (Harasim, 1990). Computer-mediated communication can promote collaborative learning, defined as "individual learning occurring as a result of group process" (Kaye, 1992, p. 1).

> Computer-mediated communication is particularly suited to the implementation of collaborative learning strategies or approaches. Collaborative learning means that both teachers and learners are active participants in the learning process; knowledge is not something that is 'delivered' to students in this process, but something that emerges from active dialogue among those who seek to understand and apply concepts and techniques. (Hiltz, 1990, p. 135)

Several requirements for successful collaborative learning have been suggested in the literature. They include: competence among group members; shared and understood goals; mutual respect and trust; creation and manipulation of shared spaces; multiple forms of representation; continuous communication; formal and informal environments; clearly defined responsibilities without restrictive boundaries; acceptance among members that decisions do not have to be based upon consensus; an understanding that physical presence is not necessary for effective communication; selective use of outsiders; and the assumption that the collaboration ends when the goal is accomplished (Schrage, 1990). Computer-mediated communication can help meet some of these requirements including creation of shared spaces, continuous communication, formal and informal environments, communication without required physical presence, and the capability to call upon resources beyond the community. Successful educational technology experiences fulfill the

following purposes: promoting collaborative efforts between students and teachers; providing access to information and tools like libraries, databases, and educational materials; and improving problem-solving and research competencies in students (Kurshan et al, p. 8).

Research on social and behavioral explanations for why technical innovations fail or succeed suggest that networks intended to facilitate scholarly communication and education should help users (Willis, 1991):

1. **Obtain** useful information in a convenient and accessible format;
2. **Exchange** knowledge with colleagues;
3. **Collaborate** to solve problems; and
4. **Cooperate** to create new knowledge.

If successful, the formation of electronic educational communities through computer-mediated communication has the potential to provide a more meaningful and relevant learning atmosphere and involve the greater community in the educational system.

> The community outreach potential for schools has many advantages, such as involving community expertise in making K-12 education immediately relevant to real-world community needs. E-mail allows student/community 24-hour interaction, opening doors to many new levels of interaction. Successful K-12 educational reform hinges on linking classroom instruction to relevant problems and issues within the local community. Education need not be confined to 50-minute periods which end at 3:00 p.m. five days a week. (Odasz, 1994, p. 11)

One of the most important elements in incorporating educational telecommunications is recognizing an essential change in the student-teacher relationship. Experts state that computer-based education is best implemented within or incorporated into a student-centered model of learning rather than the traditional teacher-centered educational model. In the student-centered approach, the teacher acts as a facilitator or coach -- a "guide on the side" -- instead of performing the traditional role of the source of information -- "the sage on the stage" (Office of Technology Assessment, 1995). Under the new paradigm, students work independently or in small groups and are presented with more complex materials; teachers tailor their instruction to the individual; and instructors spend

less time lecturing and more time working one-on-one with students. Teachers can use educational telecommunications and redefine their roles to help students to develop problem-solving skills, broaden their scientific and mathematical competencies, strengthen their communication skills, take personal initiative and learn responsibility, and acquire skills applicable to the workplace.

In Summary,

> To create high-quality, humane educational circumstances, fundamental features of the current norm must change. Creating learning environments that provide for "cognitive apprenticeships" is one way of characterizing such change. In these circumstances, students are carefully guided through work on complex, meaningful, and authentic tasks as contexts for learning and flexibly applying knowledge and strategies. Students need to work in circumstances where coaching, scaffolding, and opportunities for articulation, reflection, and collaboration characterize their interactions with adults and other learners. Students need to participate in a vibrant educational culture where work is intrinsically motivating, and lively interaction between learners and experts embodies ... their activities. (Hawkins, 1991, p. 162)

The educational system has begun to utilize this technology to encourage connectivity between educators. According to the US Office of Technology Assessment, 33 states report at least one computer network dedicated to K-12 education; an additional six states have partially operating networks, and nine states have planned networks (US Office of Technology Assessment, 1995).

Critical Success Factors

Ely and Plomp (1986) suggest the following guidelines for successful implementation of educational technology:

- Begin with the problem to be solved, not the technology or medium to be used. The technology should meet critical educational needs, for example, teacher shortages, insufficient space, etc.
- Consider the setting by conducting a needs assessment and developing a comprehensive plan.
- Design program materials to reflect the program goals.
- Focus on individual learners (students, not teachers) and enlist them as active participants in the learning process.

- Use simple, available, cost-effective technology.
- Determine the role of the teacher -- does the teacher act in the traditional role of information provider or in a new role as facilitator for independent learning?
- Establish support systems for teachers and students.
- Focus on training of measurable skills, rather than general goals.

Ely and Plomp emphasize that educational technology " ... ought to be used in response to appropriate problems. In the past, some of the less successful uses ... occurred when it was offered as a solution to a problem which had not been clearly defined" (Ely and Plomp, 1986, p. 237).

The Office of Technology Assessment (1995) outlines several organizational requirements that will help ensure the success of an educational network.

- The educational technology must be used as a vehicle or means to accomplish established and specific educational goals.
- Teachers must have unlimited access to the hardware and software at their own convenience.
- The technology should be adopted into the culture of the school for sustainability. Specifically, the school culture should develop rules to support the new educational technology practices; revise the academic curriculum to accommodate technological innovations; provide training programs; and revise student and teacher evaluation standards to support and encourage the use of new technologies.
- Teachers must be trained on how to use the resources and technology to accomplish their educational goals and how to organize classroom activities using the technology.
- User training must be redefined to include hands-on education and practice.
- The culture should provide incentives to using these technologies, including onsite technical support.
- The use of and expenditures for educational technology must be supported by both the administrative structure and the community.

Riel and Levin (1990) studied three communities for university faculty, elementary and secondary teachers, and elementary and secondary students and concluded that effective electronic communities consist of people with well-established relationships

looking for new ways to work together or of strangers with a common commitment to a specific task. Networks of strangers with no common interests or goals generally fail.

To assess users' needs and their willingness or ability to use a network, planners should ask the following questions before establishing an electronic network:

1. Does the group already exist -- do they already know each other?
2. Does the group have a need for telecommunications?
3. Is there a shared goal or task with a specified outcome?
4. Is there easy and efficient access to technology?
5. Do participants have regular patterns of accessing mail?
6. Is there a person who will facilitate group planning and work?

Riel and Levin (1990) suggest that if the answers to the majority of these questions are "yes", it should be relatively easy to establish an effective electronic community. They indicate that unsuccessful networks typically fail in two to four of these factors.

Riel and Levin (1990) found that successful networks exhibit the following characteristics:

- Participants work closely and actively with each other but are geographically or physically separated;
- All participants have easy and equal access to the network;
- There is "community" pressure to read and respond to mail regularly and in a timely manner;
- Asynchronous group communication (parties are not online at the same time) is more efficient for this group than other types of communication;
- There is a mutually shared goal or well-specified task to accomplish;
- There is a facilitator or moderator to encourage group interaction;
- There is a group structure (rather than individual-to-individual communication);
- There are established educational goals with a time line and an identifiable end product; and
- There is a coordinator or moderator to facilitate group planning.

Ely and Plomp (1986) found that educational technology efforts often failed because of the following weaknesses:

- **Confused goals**. There was no clear goal for the exchange and participants did not know why the educational technology was being used;
- **Emphasis on the medium**. Unsuccessful communities revealed a greater emphasis on the method of delivery or technology than on the instructional program or materials;
- **Resistance to change**. The technology was threatening to some potential participants;
- **Lack of support systems**. There was no daily technical or user support and the institution or social system did not encourage use of the technology;
- **Lack of skills**. There was no training or inadequate training for users, and users were not given enough time to learn the technology;
- **Expense**. There were insufficient funds to purchase hardware or software and for training;
- **Lack of quality software**. Software was not tailored to the necessary use, was culturally inappropriate, or could not be adapted to users' needs; and
- **Lack of system focus**. Educational technology projects addressed only part of the problem to be solved or goal to be accomplished.

Other factors that can threaten the success of educational networks include problems in establishing the network "community" that affect instructional components and difficulties in operating or maintaining the technical infrastructure of the network (Kurshan et al.).

Steps To Success

The following sections highlight information culled from the review of the literature and electronic resources and from the survey of electronic communities.

Address program goals and user needs.

Founders of electronic communities should assess the needs of potential users of the system and use appropriate technologies tailored to these users.

> Having peers asynchronously available is of little use to individual participants unless there are convincing reasons to interact and utilize new communications technologies instead of existing ones. It is important to anticipate and accommodate teachers' informational needs, interests, affiliatory desires, and provide a convenient topology of practical interpersonal connections if a network is to thrive" (Harris & Anderson, 1991, p. 199).

One survey respondent says "Know your audience and use every conceivable way to understand them and the specific kind of information they need. ... Make sure you have people who care that the system works and are willing to invest in providing good, wanted, timely information on a daily basis. If people don't find something they really want -- or something new -- in three logins, you've lost them."

Feenberg and Bellman (1990) stress the importance of how the electronic community is set up:

> The social architecture, to the extent that it facilitates or impedes a give kind of communication, is as important a factor in determining the success of group communication as the location of chairs, tables, blackboards, podiums, and the like in more traditional forms of human interaction. (Feenberg & Bellman, 1990, p. 68)

In their study of electronic communities, Riel and Levin (1990) evaluated the participant structures and how they affected the success or failure of the network. They determined that electronic communities can be evaluated upon the:

- Organization of the Work Group (Number of participants, common experiences, previous knowledge of each other, horizontal or vertical integration).
- Task Organization -- what is the purpose of the group? (General -- to facilitate cooperation; or specific -- to accomplish a particular goal?).
- Response Opportunities -- how easy is it to communicate? (Depends upon ease of access and the required expertise to use the network).
- Response Obligations -- what expectations and norms exist about when mail should be read and answered?
- Coordination and evaluation -- who evaluates and rates the success of the network?

Riel and Levin found that successful networks were used frequently, and that users thought the network appropriately meets their needs. Harris and Anderson confirmed that the key to successful implementation is user acceptance. "It is clear that successful

implementation is dependent upon participants' active use and adaptation of networked environments. The interactive nature of telecommunications innovations makes them too complex to be used passively" (Harris & Anderson, 1991, p. 196). Reasons cited for network failure include an inequality of contribution between discussion participants, and online conferences that do not meet participants' needs (O'Shea, Kimmel & Novemsky, 1990).

It is essential to deliver the promised services and to assign responsibility to users. One system operator says to "Have a plan and work backwards. Tell prospective users 'On opening day we will have these services ... ' then plan how to get there." Some systems have required strong user support for the mission of the network; one system operator says "Make sure that all users agree upon and sign an 'Acceptable Use Policy' before they go online. We put the policy on a gopher server and districts can customize it for their own use. Every teacher and student must sign it before getting account.

Electronic communities should monitor use and adjust services to the needs of current users. One surveyed network operator said that initially they expected that the most activity would be from 15 to 22-year-olds with a focus on information-gathering activities; in reality, the active user population is much older than expected.

Communities often make a special attempt to serve underserved populations. To reach this goal, one respondent network tries to make the service as easily accessible as possible for all groups within the community. It provides public terminals at community social centers, inner-city schools, and homeless shelters; and serves as a nationwide repository of information for Native American resources on mental health and substance abuse. Another network ensures that its Native American population living on reservations is wired. Others have provided public access terminals at local libraries. One electronic community is tailored specifically to students with disabilities and helps them succeed in the fields of math, science, and engineering through electronic mail mentoring. The computer-mediated exchange helps students become more independent and productive.

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Survey respondents' electronic communities varied in size, number, and types of users. Reported user profiles included equal numbers of women and men; citizens over 40 years of age;many retired citizens; K-12 teachers; senior citizens; 80% males with a median age of 34; and K-12 teachers, librarians, and parents. The number of registered users ranged from 650 to 400,000. Use figures also varied a great deal, and ranged from: 3,000 to 15,000 logins per day; 600 to 4,500 logins per week; and 68,450 logins per month by 4,600 registered users who spent an average of 61.30 minutes per log in. One network reported rapid and unexpected growth -- they currently average about 125 new accounts per day.

Involve the greater community.

To ensure that the information on the network meets local users' needs, one community network operator recommends that the network planning team include the following members:

- a local economic development official from the Chamber of Commerce;
- a phone company representative;
- a university computer department representative;
- a United Way representative;
- a local public radio or television station representative;
- a local newspaper representative;
- a local public library representative;
- an attorney; and
- an accountant.

Developing a broad-based community may be difficult. A report by another operator: "One problem encountered is a lack of a diverse array in community volunteers--we got many technical or library people, but no lawyers, fund raisers, accountants, or business people."

Community organizations can be involved in the ongoing maintenance of the system by providing content and information for the system. They can also be recruited as sponsors, and host institutions for equipment and Internet connections. For one network, over 250 organizations provide information. One network charges community organizations $20 per month to have their information accessible. Survey respondents reported that the following community organizations were instrumental in helping to establish and operate their community networks: community colleges, hospitals (for computer equipment donations), local businesses (for financial assistance), volunteers (for in-kind donations of manpower), local or state universities (for technical support and to host the system), local computer retailers and computer manufacturers (for equipment donations), university libraries (for information collection and organizational support), local governments (cities, counties, and towns), county public libraries, state university systems, state departments of education, individuals, and the local phone company.

Develop grassroots support.

Since educational goals should guide technology decisions, it is essential to involve teachers in planning the system (Office of Technology Assessment, 1995). Teachers are the most important element in user acceptance of education networks. Although, judging from one survey response, this may be more difficult than it appears; "...Teachers are tough nuts to crack. They LOVE to gather up information from lots of sources, but they are reluctant (don't have time or don't think they have information to share) to share information with other teachers."

Adoption can be encouraged by guaranteeing teachers' unlimited access to reliable equipment, follow up support, and coaching(Harris & Anderson, p. 195). One statewide educational network recommends grassroots efforts to promote teacher acceptance. This state provides training an other support to adopters who acted as opinion leaders and influence other teachers through interpersonal channels. Group members were selected on the basis of enthusiasm and motivation to participate, rather than on computer proficiency.

Keys to the success of this grassroots effort included teachers' unlimited access to networking facilities (available from home and office) and accompanying support mechanisms, the availability of portable computers, and the installation of phone lines in each classroom (Harris and Anderson, 1991). Several other survey respondents report the success of grassroots plans.

Promote a positive online culture.

In traditional communities an individual's involvement in the community is influenced by a bond with the group, called a "community tie" (Rothenbuhler, 1991, p. 65). Community ties in traditional communities consist of structural ties (like owning a house and working in a particular locale); social network ties (friends and relatives in this location and the frequency of interaction); participation in local organizations and the localness of the activity space ; cognitive ties (having information and ideas relevant to local issues); personal identification with the locale; and affection for and contentment with the local area(Rothenbuhler, 1991). Similarly, participation of people in electronic communities can be influenced by the number of people they form bonds with online, the caliber of their online relationship, the direct relevance of the community s information to their lives, their satisfaction with the online locale and the information provided, their degree of contribution to the community, and their mental ties to the online community and its "residents."

An important element of a successful electronic community is the way users come together, cooperate, and form a social commons while using the network. One survey respondent emphasized that "Networking is a people challenge, not a technical challenge!" Because network and resource utilization is largely dependent upon the online culture development of a positive and cooperative culture is essential. Gundry (1991) lists the following qualities of a successful network culture: collaboration and mutual support among members, openness of communication within the electronic community, informality of communication, lack of a social or organizational hierarchy, participants who take

responsibility for their own messages, and users who exercise their own judgment in accessing resources. One important quality is knowledge authority, whereby users are evaluated upon what they know, rather than who they are (Gundry, 1991, p. 175).

Conference moderators help develop community culture and maintain sustained community interaction. They can develop new conferences, serve as a model of appropriate online behavior, encourage users (especially new or reluctant users) to participate, stimulate discussion, provide relevant information, and monitor usage statistics (Harris and Anderson, 1991, pp. 199-200).

It is unrealistic to expect that individuals in the community will participate equally. In a study of new communications technology use, 10% of the users account for 50% of the uses, and the other 90% of the users account for the remaining 50% of uses (Harris and Anderson, p. 200). However,

> ...the ratio of 'readers' to 'contributors' requires close watching ... when only a handful of participants are responsible for all contributions then offline stimulating experiences may be necessary to build a better sense of community. (O Shea, Kimmel, & Novemsky, 1990, pp. 69-70)

One network operator emphasizes that is essential to create a community culture of trust and security. He suggests that network operators should be proactive in stopping harassment by implementing and enforcing policies to discourage and deal with misuse; promoting online registration that does not allow users to use aliases or false identities; and creating, publicizing, and enforcing clear rules for appropriate online behavior. Another system operator stresses the importance of an open and honest online culture. Network administrators should be honest about mistakes and should communicate regularly with users by soliciting feedback through surveys. System operators that users play an active role in maintaining the community by being involved and informed about the system by enforcing the rules when children are involved, and by taking responsibility for information on the network.

Survey respondents provide the following advice for forming a network with strong bonds within the online community: "Develop broad-based support within the

community and develop a clear vision of where you're going and who is served: make sure that your network is serving the intended community first, before worrying about outsiders."

Survey respondents shared both their expectations and their observations of the online culture that developed. One system operator said "We were told that [the developing online culture] would be difficult to control, and vitriolic ... some of that has happened, but in general it s a gentle, caring culture." Another operator noticed that different age-group "subcommunities" developed with specific needs and behavioral norms; for example, smaller reference groups of teenagers and graduate students developed their own online cultures. On another network, "a number of teachers have become online groupies. They chat every night, developing lesson plans and cooperative classroom learning."

Operators have also encountered minor setbacks. One system operator expected a community spirit to develop, but this has not materialized; "Most people are still loners, but at least they are better informed." Another stated that users are "hooked on [the network], but disgruntled with slowness and access problems due to lack of funds to increase and improve infrastructure quickly."

Deliver appropriate instruction.

According to Harasim (1990), successful online educational supports the following types of learning:

- **Idea generating** -- Developing original ideas. Examples are brainstorming, discussing alternatives, sharing information, and debating.
- **Idea linking** -- Identifying ties and connections between ideas and pulling them together. One example is development of semantic maps.
- **Idea structuring** -- Organizing ideas into a structure and using it to answer a question or solve a problem. One example is writing a research paper.

Bailey and Cotlar (1994) include the following uses of computer-mediated communications as effective avenues for learning.

- **Student-Student Interaction**, including collaborative projects with faculty and students at distant schools

- **Electronic guest lectures** which bring experts on a particular subject into direct contact with students and allow citizens in the greater society to help educate children; and
- **Electronic forums and panels** when congregations of groups of remote panelists share specific topics with student audiences.

To encourage productive use of computer-mediated communication, it has been suggested that students be required to post a minimum number of messages per week; that important information be posted online only; that students' grades be partly based upon their computer interaction, and that group projects that require online collaboration be assigned (Wells, 1992).

Similarly, the school can encourage and sustain the use of technology by administrators and teachers. The school culture should encourage new practices and rules to encourage the use of new technologies; initiate curriculum revisions to include new educational technologies; implement training programs; and modify curricular and instructor evaluation procedures to encourage the use of new educational technologies.

To ensure full teacher participation, the typical barriers to teachers' widespread adoption of telecommunications activities must be overcome. Currently, teacher access to appropriate technology is limited because of the high cost -- some teachers do not even have phone lines in their classrooms, much less computers or modems. Many teachers have not been taught how these resources and technology can help them accomplish their educational goals or how to organize classroom activities to incorporate these new technologies. Teachers are also inadequately trained on the use of the systems. Often, technical or logistical problems, like a lack of onsite technical support for teachers, result in frustration with the technology. Most importantly, the current academic system measures success through student test scores; however, students increased computer literacy may not help to raise these test scores. Finally, policy issues of copyright, intellectual property, privacy, and the possibility of students encountering objectionable materials online have complicated and foiled online access (Office of Technology Assessment, 1995). Survey

respondents confirmed that some of these barriers to widespread implementation do exist within their communities. "One of the biggest barriers is that teachers don't have computers and/or modems. Also, there are no phone lines in the classroom." One network operator cited the following barriers to network use: lack of connectivity, shortage of computers in schools, lack of staff development or training, inability/hesitancy to integrate curriculum into the technology, and insufficient funding. When one network conducted a focus group to determine teacher information needs, participants listed the areas of alternative assessment, interdisciplinary programs, best practices, solutions to common problems, and specific applications to teach content

Survey respondents provide access to the following educational resources and services: local university and community college educational resources; the Learning Link Network; MicroNet K-12 Network; Academy One (K-12 Network by National Public Telecomputing Network); Armadillo (Texas Educational Gopher); National School Network Testbed; Consortium for School Networking resources; Discovery Learning Community (sponsored by the Discovery and Learning Channels); Geometry Forum Archive; HotList of K-12 Internet School Sites (sackman@plains.nodak.edu); Keypals (electronic pen pals); MathMagic (K-12 problem solving project for math discussions); World Wide Web resources like the Global Schoolhouse Project; news groups on educational topics like math, science, and elementary education; educational conferences regarding curriculum; student language exchanges with French, German, Russian, Spanish and Japanese native speakers; collaborative projects between classrooms at different schools; CNN Newsroom Teacher Guide; Daily Report Card education news; Grant Opportunities listings; and transmission of SAT and student transcripts between students and colleges to which they have applied.

Adhere to a reasonable timeline.

Developers of electronic communities should not expect immediate results and must allow enough time for users to develop an online culture. Five years is a reasonable time

frame for large-scale technology adoption (Office of Technology Assessment, 1995). Survey results confirm that the community-building process is evolutionary rather than immediate; one network is just beginning to establish an identifiable online culture after two years of operation. One survey respondent emphasizes that it takes time to build an electronic community, and that users must be ready to use the system before implementation will be successful. "We tried the top-down approach for several years and it limped along. Perhaps because it was too early and few schools had equipment. So we put it on hold until bottom-up pressure to establish the network began ... It took four years to get all school districts to join the network voluntarily."

Electronic communities can become established more quickly if they make use of established electronic resources. As one network operator stated "Using existing network resources allowed us to reach 'critical mass' much sooner than if we had launched an entirely new proprietary service." Factors to consider when selecting an existing network for the community: current participants, user interface, Internet connectivity, support services, features (like information retrieval capabilities), organization, and costs (Kurshan et al., 1994).

Some survey respondents suggest that network adoption should begin on a small scale. One way to encourage user acceptance is to first create a core of "adopters" or "opinion leaders" who will spread information and teach others. Another network operator advises to start slowly -- they initially provided links to junior high and middle schools only; there is currently inadequate funding to include K-6, but they will be connected as funds permit. Another operator advises to start slowly with a targeted plan.

> Start with a small group. Develop the vision statement (i.e. do not become a free Internet service); incorporate; set up pilot system; recruit institutional information providers; don't charge (donations exceed charges); and replace the initial test group out of the community within one year.

Survey respondents warn that new communities should be prepared to invest a great deal of time and research in establishing a system. Organizers should also allow time to locate resources for key participants to become educated. For example, one network

operator gives the following advice: "Obtain the Morino Foundation report [http://www.morino.org]. Attend conferences [like the "Ties that Bind" community network conference sponsored by Apple Computer and the Morino Foundation]. Sign up for the Communet Listserv and news groups. Don't get discouraged."

Address technical and support issues.

The Virginia Department of Education recommends the following technical guidelines for networks (Bull, Harris, Lloyd, and Short, 1991). Systems or networks should:

1. Be compatible with the existing state university system;
2. Be based on a distributed computing system;
3. Have a simple E-mail user interface; and
4. Offer a common mail interface to all school districts in the state.

A more recent report on the essential qualities of statewide network systems reaffirms these technical specifications and adds others. The single most important requirement is that the system is compatible with existing Internet standards to ensure a seamless telecomputing system from kindergarten through graduate school (Bull, Sigmon, & Shidisky, 1991, p. 184). The network should be accessible from any widely-used computer platform or brand of computer and should have a simple and easy-to-use user interface. Finally, the network should be equally accessible to all school systems regardless of geographic location or tax base (Bull, Sigmon, & Shidisky, 1991). It has been suggested that an educational network should have user-friendly menus and tutorials, be accessible from all platforms (including IBM and Macintosh), offer dial-in access through a toll-free number, and not charge membership fees or access charges (Wolpert and Lowney, 1991).

Survey respondents provide their members access to the following tools: electronic mail, Gopher, Archie, WAIS, World Wide Web (through Lynx and Netscape), newsgroups, File Transfer Protocol (ftp), and Telnet. They revealed that the most popular

services are bulletin boards (BBS), gopher services, electronic mail, Web servers, and USENET groups.

The hardware and software used by respondents includes: HP 9000/360, IBM-compatible personal computers and Macintosh, Sun SPARC 10/41, Sun SPARC 20, VAX computer, and IBM RISC 6000 hardware. Software includes: PINE electronic mail, Pico, Windows-based applications, PC-DOS, Freeport Software (Free Net Software), UNIX-based software, SYSCOS network, All-in-1 e-mail software, VMS software, and World Wide Web server software.

One of the most significant factors of successful networks is well-trained users. Participants' inability to learn the system due to inadequate training has been cited as a primary reason for network failure (O'Shea, Kimmel, & Novemsky, 1990). Many suggest that, since teachers are the key to successful infusion of educational technologies, funding and resources should fully support their training (Harris and Anderson, 1991, p. 193). The National Educational Association (NEA) recommends that teacher training should be teacher-planned, practical, hands-on, and conducted in regular sessions at the school's expense and during teachers' normal working hours (Harris and Anderson, p. 197). Training for teachers must be:

> operationally defined, perceptively planned, flexibly conducted, meticulously performed, and carefully evaluated. It must be well-structured, time-efficient, reasonably paced, respectful of individual intelligence, experience, and learning differences, and, above all, *practical*. (Harris and Anderson, p. 197)

Examples of effective training practices include: site visits and technical support for late starters and less technically competent users and a printed newsletter informing teachers of new features (O'Shea et al., 1990, p. 69). Fowler and Wheeler (1995) suggest that structured guidance for teachers be provided through a buddy system with other teachers and teachers and students be given adequate time to learn how to use the equipment. The US Office of Technology Assessment recommends teacher training include distance conferencing, online professional training, onsite technical support, resources for lesson planning, online discussion groups and resource sharing forums, mentoring, case studies

of effective teaching, instruction on the use of technologies, advice on how technologies can help them reach their educational goals, and education on engaging students to learn using computers (Office of Technology Assessment, 1995).

Examples of effective teacher training practices in educational technology include developing "master teachers" or "local experts" who can help and train others; giving every teacher a computer; training school administrators alongside teachers; providing expert support sources from outside groups (parents, community members, librarians, etc.); and giving teachers time to learn technologies and to plan lessons incorporating these technologies. Students must also be well-trained. One successful example is the "Super Subs" Program, in which teachers on early retirement and technically proficient provide lessons using educational technology to students in the classrooms. Regular teachers observe and learn, but do not have to prepare the lessons (Office of Technology Assessment, 1995).

Survey respondents shared their training practices. One operator emphasizes "Train, train, train. People will NOT take to this like ducks to water. Provide a reliable system (people will give up after three tries if it doesn't work). Another network offers a two-tiered training program, where both tiers are considered essential. First, they train technical people on software support; next, they train teachers on how to implement technology into the classroom and their curriculum. Another network offers practically unlimited user training, including: online help; an online user manual; onsite training at libraries; one-on-one assistance from network staff; help forms to ask help staff questions; four help news groups; seminars for hundreds of people per week at community and campus question and answer sessions; and telephone support for users. Another network provides minimal user training because the system is easy to use. Group sessions are held by field coordinators and librarians around the state. Teachers can also order transparencies and presentation packets for training their peers. The network also provides a simple booklet with how-to information and strategies for using the service.

Obtain financial and administrative support.

Financing is a fundamental issue for educational networking. An Office of Technology Assessment Report reports that schools currently expend 55% of their technology budget on hardware, 30% on software, and 15% on training. However, states with successful educational technology programs recommend a different ratio: 30% on hardware, 30% on software, 30% on teacher training and staff development, and 10% on system maintenance (Office of Technology Assessment, 1995).

Sources of funding include: donations, corporate sponsors, user fees, foundations, charges for services, in-kind contributions, volunteer support, Small Business Administration funds, equipment donations, local corporation donations, federal funding, and local and state government monies.

Survey respondents contributed advice regarding network financial operations. One system operator states "Treat the process like a business. This is 1995 and non-profits running in traditional mode will not survive. If the local community won't support the project, then don't do it." Another network gives the following advice on relations with funding sources: "Get the 'major players' responsible for funding to 'buy in' to the advantages of network access. Make sure they understand this is not a one-time issue. Although there are initial equipment purchases, the recurring costs will always be there." One network recommends establishment of a 501(c)(3) Corporation.

Reported budgets for the networks cover a wide range: from $10,000 to $250,000 per year. One network receives $3.5-4 million per year from the state. Another network has a $1,500 per month telephone bill which they cover by donations. Most survey respondents do not charge their users substantial user fees; reported charges ranged from no fees, to donations requested, to $10 per month flat fees, to $11.50 per hour.

A common theme among survey respondents is that operating a network requires a great deal of time. Most of the respondents depend upon the extra time of paid staff and the generosity of volunteers. One operator emphasizes the importance of volunteer labor and

recommends hiring a volunteer coordinator to take this responsibility off the shoulders of the already-burdened network operator. Staffing levels varied from all volunteers; to four paid staff and 40 volunteers who each donate at least 10 hours per week; to two full-time workers plus 130 volunteer hours per week; to 34 paid full-time staff.

Conclusion

The formation of electronic educational communities offers a chance to rework the educational system and capitalize upon the strengths of computer-mediated communication. If implemented properly and accepted by their users, electronic communities can potentially have far-reaching effects. They can promote active and collaborative learning among students; provide new, up-to-date, and interactive educational resources; as well as enhance the strengths and overcome the limitations of the traditional classroom environment. The use of computer-mediated communications in education has been heralded as a means to facilitate lifelong education and training, encouraging people to learn from grades K-100. In order to meet these weighty expectations, founders of electronic communities must establish communities that meet the needs of their users, encourage and depend upon community involvement, are initiated through grassroots support, promote a positive online culture, deliver relevant and targeted educational instruction, are established within a reasonable timeline, provide enough technical support to develop effective users, and attract financial and administrative commitment.

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